

HAMILTON (J. B.)

# DRAINAGE OF CHICAGO.

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BY

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*Read at the Seventeenth Annual Meeting of the Mississippi Valley  
Medical Association, held at St. Louis, Mo., Oct. 14-16, 1891.*

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Reprinted from "The Journal of the American Medical  
Association," October 24, 1891.

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1891.



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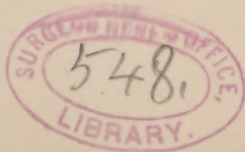
The distinguished chairman of the committee of arrangements informed me that a short address of some kind would be required of me at this meeting, and that as the audience would not be confined to members of the Mississippi Valley Medical Association, some topic connected with public hygiene should be selected.

Being sincerely desirous to please my amiable friend, Dr. Love, I thought it might not be inappropriate to briefly consider a topic of interest to all the members of the Association, namely, the Drainage of Chicago.

There are some side questions connected with this subject that are of very great interest, and I shall refer to them, but the limitation of time will only afford opportunity for a statement of the sanitary problem, and of the manner in which those in authority propose to solve it.

### TOPOGRAPHY AND CLIMATOLOGY.

Let us glance at the topography of Chicago as it was before artificially changed.



The oldest map of this region<sup>1</sup> is said to be still in existence in Quebec, and bears date of 1688.

Lake Michigan is correctly outlined, and the Chicago river properly placed and the French "Fort Chicago" located at its mouth. This map gives the formation of the Illinois river from the Desplaines and Kankakee. From the report of Surgeon-General Lawson,<sup>2</sup> in 1840, I quote the following:

"Fort Dearborn, lat.  $41^{\circ} 51'$  N., long.  $87^{\circ} 15'$  W. This post, now abandoned,<sup>3</sup> is situated on the southwest shore of Lake Michigan, in the State of Illinois, twelve miles from the Wisconsin line. It is distant from the lake 250 yards, and is elevated fourteen feet above its surface. The river Chicago, which runs on the three sides of the fort, divides half a mile above it into two branches, the one north and the other south, in directions nearly parallel with the lake shore. As the bank of the lake is several feet higher than the ground in the rear, the latter is sometimes covered with water. Indeed, the whole country is so low that in its early settlement boats frequently passed, during the spring floods, over the prairies from Chicago to the Illinois river. At this post the prairie opens upon the lake four miles wide, extending west beyond the reach of the eye. Above and below this point, the shore of the lake is densely covered with large forest trees, such as the different varieties of oak, ash and hickory. The soil is generally a rich loam; in some places clay, in others sand, predominating. Limestone is found in large quantities. . . . This po-

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<sup>1</sup> Davidson and Stuvé's History of Illinois.

<sup>2</sup> Statistical Report on the Sickness and Mortality in the Army of the United States, from January, 1819, to January, 1839. Washington, 1840.

<sup>3</sup> Fort Dearborn was established in 1804. J. B. H.



sition is one of our most salubrious military stations."

Dr. Drake<sup>4</sup> in 1848, in his classical work, wrote: "Chicago, the commercial metropolis of Lake Michigan, stands on a low sand plain, on the western side of the lake. The breadth of this flat along the lake is about four miles, whence it runs back ten or twelve miles to the river Desplaines, an elementary branch of the Illinois. When the lake stood at a level only twenty feet higher than at present, its waters overspread this bed of alluvion, and a portion of them flowed down the Illinois. At this time it is a savanna, abounding in marshes and low sand ridges, traversed by the river just mentioned on the west and on the east by the north and south forks of the Chicago river, or creek; which, flowing nearly parallel with the lake shore, unite within it and form a short common trunk, which meanders through its centre to the lake. The water in this natural channel is twenty feet in depth, and rises and falls from the force of the winds upon the lakes about two feet; a fluctuation which tends to carry away the filth which would otherwise accumulate on its margins, from the houses on each side, and from the vessels which seek it, as the only harbor of Chicago. From the mouth of this river there is a gradual rise of the plain to the height of twenty feet; which may be attained by ascending the south fork of the river to a spot whence streams sometimes flow to the east and west on which canoes have passed from the lake into the Illinois river. The canal from Chicago to Peru now passes over that summit level which is the lowest between the Gulf of St. Lawrence and the Gulf of Mexico, being in

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<sup>4</sup> On the Principal Diseases of the Interior Valley of North America. Cincinnati, 1850.

round numbers only six hundred feet. Near the lake shore the winds are constantly blowing a fine dark colored sand on the margin of the plain, which south of town is raised into low ridgy dunes. The town-plat, from the destruction of the coarse aquatic vegetation, and the tramping of men and animals, is constantly becoming dryer and firmer. Beyond these influences much of it inclines to marshiness; but as it is not subject to inundation and is high enough above the Chicago and Desplaines rivers to be drained by a judicious system of ditching, it will no doubt, as population increases, be entirely reclaimed. . . . In the year 1831 the town itself was commenced, and at this time, 1848, its population is near twenty thousand. The city is supplied with water from the lake, through a hydrant system; a growth so rapid indicates its prospective importance and entitles it to the regard of the Medical Topographer. . . . The statements of Doctors Boon, Davidson and Brinkerhoff fully sustained the impression made by the others (Brainard and Kimberly) and convinced me that the town of Chicago has been more infested with autumnal fever than Fort Dearborn had been; which goes to strengthen the prevalent opinion that the first exposure of the new soil to the sun, rain and air is insalubrious. A part of this upturning was by the plow, another by the spade in the excavation of the canal. This operation deserves some notice. The canal stretches southwesterly from the town completely across the plain. One of the contractors told me that in 1838 he had excavated a mile. The average digging was to the depth of four feet through a soft black mould, abounding in organic matter. The distance to which this silt was spread out on each side was such as to cover a parallelogram

of the average width of two hundred and eighty feet exposed to the sun and rain. Nearly all who resided along the line of excavation sickened with autumnal fever; and almost all the laborers (Irish immigrants) suffered in the same way. Several died with malignant or congestive symptoms."

Such were the natural conditions, forty years ago, and now there has been placed upon the naturally unpromising site, more than a million of people, and it is estimated that since the census was taken there has been nearly two hundred thousand souls added to the population.

#### DRAINAGE.

Within ten years after the period mentioned by Dr. Drake, the river had become so contaminated as to cause uneasiness, and in 1855 the Illinois legislature passed an act creating the Board of Sewerage Commissioners, and in 1856 the systematic construction of sewers was commenced, and soon the Chicago river became what it now is, little else than an open navigable sewer. It soon became evident that some system of cleaning the river must be adopted, and in 1860 the sewerage commission recommended the widening and deepening of the canal. Not only to provide a sewer outlet, but to accommodate the increasing needs of commerce with the interior. This idea soon expanded into the project of a ship canal, which now seems near realization. The legislature, in 1889, passed "An Act to create Sanitary Districts and to remove obstructions in the Desplaines and Illinois rivers." This act created a Board of Trustees and gave them the necessary powers.

The Board have now completed the survey of the proposed canal route and are engaged in con-

demnation of the real property through which the canal must pass.

This conclusion was reached by the legislature only after exhaustive inquiry into the various plans proposed and the existing conditions, by the State Board of Health. That body reported, through its secretary, Dr. Jno. H. Rauch, who had for many years given the subject his careful attention, that the water supply of the city was endangered by the river emptying into the lake; and that the pumping works were inadequate to continuously change the current of the river; that sewage can not be profitably utilized as a manure, and taking out the solids by chemical treatment does not render it safe for domestic purposes; that seventy per cent. of the Chicago sewage passed down the Desplaines and into the Illinois river; and that the proposed canal would cost less than any other mode of the disposal of so large a body of sewage. The board further demonstrated in answer to the fear of those in the Illinois valley, that the river was already greatly polluted by the sewage of the several towns and cities in the Illinois basin, and that in the near future it would be necessary to flush the Illinois from Lake Michigan even if the Chicago sewage were otherwise disposed of.

The soundness of these arguments prevailed, and it is now proposed to construct a canal that will give a dilution to the sewage of 60,000 cubic feet per minute for each 100,000 of population, and not less than 24,000 cubic feet per minute when the population shall have reached 2,500,000.

The following tables were extracted for Mr. Artingstall from the report of the State Board of Health:



ANALYSIS OF WATER OF THE ILLINOIS AND MICHIGAN  
CANAL AND ILLINOIS RIVER.—("A.")

Parts per 1,000,000. Summer 1888. (Table from State Board of  
Health Reports.)

Place.	Dis- tance	Water- shed sq. miles.	Total solids	Suspend- ed Matter.	Chlorine.	Free ammonia	Albumin- oid ammonia	Oxygen consum'd	Nitrogen as Nitrates.
Bridgeport . .	0		47.12	12.92	4.68	1.225	0.256	2.31	0
Lockport. . .	28		43.12	6.98	4.61	1.088	.199	1.62	0
Joliet, Upper.	33	1,392	44.17	9.40	3.91	0.745	.167	1.57	0
Joliet, Lower.	34		44.27	10.79	4.37	0.893	.168	1.43	0
Morris . . . .	58	7,296	35.59	3.08	3.21	0.411	.071	1.09	.038
LaSalle. . . .	95	11,847	34.57	5.03	1.97	.064	.053	0.86	.104
Henry . . . .	124	12,642	30.60	2.75	1.77	.047	.048	0.87	.068
Peoria . . . .	159	13,479	32.98	5.43	1.24	.021	.052	0.98	.089
Pekin . . . .	170	13,831	35.30	8.43	1.62	.064	.065	0.94	.080
Havana. . . .	201	15,364	30.18	4.54	1.16	.034	.043	0.81	.073
Beardstown .	232	23,444	39.00	8.47	0.75	.020	.038	0.74	.062
Grafton. . . .	322	27,914	30.16	5.03	0.92	.009	.048	0.73	.058
Mississippi River at Alton	340		27.86	7.52	0.41	.017	.036	0.74	

ANALYSIS OF WATER OF SOME OF THE TRIBUTARY  
STREAMS OF THE ILLINOIS RIVER.—("B.")

Parts per 1,000,000. Summer 1888. (Table from State Board of  
Health Reports.)

Place.	Total solids	Suspend- ed matter.	Chlorine.	Free ammonia	Albumin- oid ammonia	Oxygen consum'd	Nitrogen as Nitrates.
Dupage River below Joliet. . . . .	29.47	1.41	0.58	.042	.035	0.47	0.31
Kankakee River below Joliet. . . . .	25.14	3.56	0.14	.008	.059	1.44	.009
Fox River below Morris	33.03	4.63	0.42	.012	.047	0.68	.003
Big Vermillion River below Morris . . . .	45.06	8.78	0.55	.013	.034	0.69	.036
Little Vermillion River below Morris . . . .	37.31	3.08	0.57	.018	.041	0.72	.036
Sangamon River below Havana . . . . .	31.78	7.07	0.36	.005	.028	0.55	.075
Mississippi River . . .	27.86	7.52	0.51	.017	.036	0.74	

The Citizens' Association of Chicago, established in 1874, composed of most influential citizens, also warmly favored the Desplaines outlet system, and by many cogent arguments favored it. The only objection worthy of consideration that has been urged against this plan is

the allegation that the danger to the people drawing their water supply from the Illinois river will be materially increased. This objection cannot be set aside by a general denial. They assert that pathogenic germs in sewage are not destroyed by dilution and that the solid matters are simply deposited with silt on bars and shoals. This view has lately been strongly supported by Frankland at the Congress of Hygiene and Demography, held in London, Aug., 1891. Frankland asserts that chemical evidence of the self purification of the waters is insufficient, that there must be a bacteriological examination as well. He admits, however, that sedimentation, (or the subsidence of solid particles) carries with it a very large number of microbes, and the fact remains that dilution, oxidation and sedimentation are so far the only known means of comparative purification of running streams.

Of these the current belief is that dilution is most efficient factor, and its effects on sewage is the same as is observed in the dilution of gas from chimneys. No one claims the destruction of noxious gases, but when poured into the open air they become so diluted as to be practically harmless.

At the same time it cannot be too strongly urged upon municipal authorities, that contaminating substances be kept out of running streams as much as practicable. Garbage can always be burnt, and other substances can be disinfected before being turned into the sewer.

But notwithstanding these precautions, and notwithstanding the great dilution proposed, in my judgment, intercepting sewers, to be constructed on each side of the river, and the lake front as well, will inevitably become necessary with the growth of the city.

## THE WATERWAY SIDE OF THE QUESTION.

I have thus far only reviewed the case from the standpoint of the sanitarian. There is another view almost as broad, and that is from the standpoint of the publicist. This involves the question of the physical effects of creating a new river 200 feet wide and 18 feet deep, the probable lowering of the lake level; the economic results of the vast waterway thus created, by providing means for increase of traffic, and additions to the trade of the valley, and the political effects of the closer commercial relations between the people on the borders of the lake, river and gulf, but as my time has already expired, I will refer you to the excellent paper of Mr. McMath, C. E., of St. Louis, and the elaborate one of Mr. Cooley.

## DEFORESTATION.

I cannot close without reference to a topic of the utmost demographic importance to this entire valley, and that is, the subject of deforestation.

The National Conference of the State Boards of Health which met in Nashville, May, 1890, adopted the following resolution:

*Resolved*, That recognizing the well-known evils resulting to the whole nation from the disastrous floods which within recent years have taken place along the valleys of our great rivers; and from the destructive cyclones which from time to time occur, both of which evils have been pointed out to be due mainly to the cutting down of the forests on the mountains and along the hillsides where our great rivers take their origin, and to the violence which the wind storms obtain blowing over great tracts of practically treeless prairie, this National Conference of Health Officers desires most earnestly to bring these evils to the attention of our Federal government, our State and provincial legislatures, and other scientific and commercial bodies, urging them to take such comprehensive action as will (1) cause a survey to be made of the gathering grounds of our great rivers.

(2) Preserve, and replant when necessary, these areas, with protective forest trees. (3) Establish schools whereby the principles and practice of forestry will be taught, and protect by the most stringent legislation the results of the above mentioned work. (4) Make recommendations to our towns and cities to form park associations for the planting of trees and obtaining possession of waste lands to be gradually reforested.

Last year at about this season, I made a journey through Italy and saw the Appenines extending from the north to the south of Italy, as an almost treeless, rocky ridge. The soil had long ago washed down the sides, and the almost everlasting rocks stand out as monuments of the ignorance and wastefulness of man.

We, in this yet new world, should realize that deforestation means general devastation, and that unless checked, our country may also become a desert. We may see in the orient, what may be the result of the fatalistic doctrine of "letting posterity take care of itself," and we may see in the example of Germany a nation strong and vigorous, that guards its forest trees as the "apple of its eye."

We have the power to stay the floods, to regulate the seasons, to preserve the natural water courses, and prevent much disease by increasing the tree bearing area, and surely our countrymen have wisdom enough, and patriotism enough to lend their influence toward reforesting of all waste lands, and the establishment of parks in every village.

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<sup>1</sup> Discussion on the Levels of the Lakes as affected by the proposed Lakes and Gulf Waterway by Messrs. Wisner, Cooley, Haupt, Herschel.





